Institutional Investment Constraints and Stock Prices

Online Appendix

Institutional investors are usually viewed as being better informed than individual investors;[1] However, because of investment constraints such as diversification requirement and tracking-error restrictions, money managers may not fully take advantage of their information in their investment decisions. In the main body of the paper, we provide evidence supporting our hypothesis that institutional investment constraints cause price underreaction to news for stocks affected by the constraints and induce cross-sectional return predictability. In this appendix, we provide some additional results and differentiate our results from those in related studies.

I. Institution Trading for Overweight vs Underweight Stocks

Table 2 of the main text reports the aggregate institutional trading activity for stocks experiencing different levels of institutional investment constraints. We find that institutions are less likely to buy more of the stocks that they already overweight or sell stocks that they already underweight. In unreported robustness checks, we find that the differences in institutional trading patterns between stocks they overweight and stocks they underweight persist beyond the two quarters documented in Table 2 of the main text. Further, differences in institutional trading behavior for stocks they already overweight and for stocks they already underweight become even bigger when we focus on stocks with significantly good or bad news (those that fall into the top or bottom quintile ranked on stock returns over the six months period immediately following the measurement of overweight ratio).

We also look at institutional trading activities separately for the cases where an institution currently overweights a stock and for the cases where an institution currently underweights a stock. More precisely, for each stock in each quarter, we assign institutions into one of two groups, based on our classification of whether an institution overweights or underweights a

[1] See, e.g., Grinblatt and Titman (1989, 1993), Daniel, Grinblatt, Titman, and Wermers (1997), Sias and Starks (1997), Nofsinger and Sias (1999), Wermers (1999, 2000), Chen, Jegadeesh, and Wermers (2000), Chakravarty (2001), Chen, Hong, and Stein (2002), Bennett, Sias, and Starks (2003), Kacperczyk, Sialm and Zheng (2005), Jiang and Sun (2014).

stock. We then compute the average change in the stock ownership for each of the two groups of institutions over the next six months. Finally, we take averages across stocks and over all quarters in our sample. We find that 'overweighting' institutions as a group reduce their ownership of a stock they currently overweight by an average 1.08% over the next six months, while the 'underweighting' institutions increase their ownership of a stock they currently underweight by 1.54%. These results confirm that institutions are constrained from buying more of the stocks they already overweight, or from selling stocks they now underweight.

II. Long-Horizon Pricing Effect of Institutional Investment Constraints

Table A1 reports the average monthly returns for equal-weighted portfolios double sorted on price momentum and overweight ratio, over the 12 and 24 months after portfolio formation. Table A1 has the same format as Table 4 Panel A (where holding period is 3 or 6 months), and the results are similar as well. We still find that among past winner and past loser stocks, those with high overweight ratio tend to have higher subsequent returns. For example, corresponding to $K = 12$ months, the difference between the average monthly return of high overweight ratio winners and low overweight ratio winners is 0.23% and is highly statistically significant. Similarly, high overweight ratio losers on average outperform low overweight ratio losers by about 0.25% per month during the six months after portfolio formation. After controlling for size and book-to-market characteristics portfolio return, high overweight ratio stocks still significantly outperform low overweight ratio stocks by about 0.2% per month among both past winner and past loser stocks. Further, this predictive power of overweight ratio for future stock return is U-shaped. The differences in the returns between stocks with high and low overweight ratio are not significant among stocks that are neither recent winners or losers.

In the main body of the paper, we have documented that the momentum strategy is more profitable for winner stocks overweighted by institutions and loser stocks underweighted by in-

stitutions. This occurs because among past winner stocks, those that institutions overweight tend to have the highest future returns, and among past loser stocks, those that institutions underweight tend to have the lowest future returns. These results are motivated by our hypothesis that institutional investment constraints cause price underreaction for constrained stocks: because institutions have difficulties buying stocks that they already overweight or selling stocks that they already underweight, stocks overweighted by institutions underreact to good news and stocks underweighted by institutions underreact to bad news.

It is well known that profits of traditional momentum strategy revert over the long run. An interesting prediction of the underreaction hypothesis above is that there should be no long-horizon reversal in the profits of momentum strategy when applied to winner stocks overweighted by institutions and loser stocks underweighted by institutions. Figure A1 supports this prediction. It depicts the cumulative buy-and-hold returns to three momentum strategies in event time during the 12 quarters following portfolio formation. All three momentum strategies are formulated using past 6-month returns.

As shown in Figure A1, the cumulative return to the momentum strategy that invests in winner stocks overweighted by institutions and loser stocks underweighted by institutions does not revert over the three-year horizon. This holds either using overweight ratio (Graph A) or residual-IO (Graph B) as the constraint measure. By contrast, cumulative return of the traditional momentum strategy that buys all past winners and sells all past losers starts to decline in the fourth quarter after portfolio formation. The momentum strategy that invests in stocks without institutional investment constraints experiences the biggest return reversal over the long run. Regardless of the holding period, the momentum strategy that invests in stocks facing institutional investment constraints always delivers the highest returns.

In unreported results, we find that among past winner stocks, those currently overweighted by institutions continue to outperform those currently underweighted by institutions over the three years following portfolio formation. Similarly, among past loser stocks, those currently underweighted by institutions continue to underperform those currently overweighted by insti-

tutions over the three years following portfolio formation. There are no reversals in these return comparisons. These results again are consistent with our hypothesis that prices underreact to news for stocks facing institutional investment constraints.

III. Relation to Prior Research

First, we relate our findings to the asset pricing impact of short sales constraints. Several recent studies (e.g., Chen, Hong, Stein (2002), Asquith, Ritter, and Pathak (2005) and Nagel (2005)) find that stocks with low institutional ownership experience tighter short sales constraints and subsequently have abnormally low returns. The constraints we measure empirically are different from the short sales constraints. Most important, we emphasize buying constraints as well as selling constraints. Secondly, while restrictions on short sales dictate that institutions may not sell the stocks they do not already own, the selling constraints in our case apply to stocks that institutions own but already underweight.

Given the differences between short sales constraints and what our constraints measures capture, it is not surprising that the asset pricing implications are not the same. Low (resp. high) overweight ratio stocks are not the same as low (resp. high) institutional ownership stocks, or stocks with high (resp. low) short sales constraints. Different from the finding that momentum profits are much stronger for stocks with high short sales constraints (e.g., Stambaugh, Yu, and Yuan (2012)), our Table 4 indicates that momentum profits are actually stronger among the low overweight ratio stocks. Further, short sales constraints obviously can not explain why high overweight ratio winner stocks continue to have strong momentum.

We use Fama-MacBeth cross-sectional regressions to further differentiate the asset pricing impact of our constraints measures from that of short sale constraints. In Model 1 of Table A2 Panel A, we control for the short sales constraints using change in the breadth of ownership variable as the proxy for short sales constraints (see Chen, Hong, and Stein (2002)). Change in the breadth of ownership of a stock is computed as the percentage change of the number of

institutions that owned the stock over two consecutive quarters. After controlling for the short sales constraints, our overweight ratio variables continue to be significantly and positively related to future stock returns. The magnitudes of their coefficient estimates barely change compared to the case without the short sales constraint regressor, as reported in Model 2 of Table 6 Panel A. These results confirm that our measures of investment constraints contain useful information not captured by short sales constraints.

Secondly, we argue for slow information diffusion arising from the inability of institutional investors to fully act upon their information when they face investment constraints. The literature has examined slow information diffusion induced by market frictions such as delay in communication or lack of attention on the part of some investors. For example, Hong, Lim, and Stein (2000) use residual analyst coverage as a proxy for the speed of information diffusion. They find that momentum strategies work better among stocks with low analyst coverage, especially for the past loser stocks.

In Model 2 of Table A2 Panel A, we add the interactions of residual analyst coverage with the past winner dummy and with the past loser dummy as regressors. Our overweight-ratio variables continue to be significantly and positively related to future stock returns in the presence of residual analyst coverage variables. The magnitudes of their coefficients are only slightly reduced compared to Model 2 of Table 6 Panel A where the residual analyst coverage regressors are absent. This suggests that our findings are largely independent of, and can not be explained by the results of Hong, Lim, and Stein (2000). Our constraints measures capture different aspects of slow information diffusion than Hong, Lim, and Stein (2000).

Hou and Moskowitz (2005) construct another delay measure that captures lack of investor recognition, and find a significant premium for firms with high delay. But the delay premium can not explain why high overweight ratio stocks have significantly higher returns than the low overweight ratio stocks, because the high overweight ratio stocks have high institutional ownership, and Hou and Moskowitz (2005) find that stocks with high institutional ownership have low delay. Further, Hou and Moskowitz (2005) find that spread in returns between high

delay and low delay firms comes mainly from the high delay firms which comprises on average less than 0.02% of the total market cap of publicly traded U.S. stocks. In contrast, the impact of investment constraints on stock returns that we document applies to a much more general universe of stocks including large stocks and stocks with significant institutional ownership.

We further include in the Fama-MacBeth regressions several variables known to be related to momentum profits in previous studies. Specifically, Lee and Swaminathan (2000) show that momentum profits differ across stocks with different trading volume. Sagi and Seasholes (2007) find that momentum strategy using stocks with valuable growth options outperform traditional momentum strategies. Zhang (2006) finds that information uncertainty, as proxied by firm size, firm age, analyst dispersion, volatility, analyst coverage, affects the cross-sectional variation in momentum profitability. We follow exactly these studies to construct the variables and include them in the Fama-MacBeth regressions in Table A2. Lee and Swaminathan (2000) use trading volume to interact with momentum for stocks listed on the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX). The trading volume is defined as the average daily turnover over the same horizon of past return measures. For stocks traded on the National Association of Securities Dealers Automated Quotations (Nasdaq), we follow Gao and Ritter (2010) to adjust the inflated volume issue which is due to the double counting of dealer trade (e.g., Gould and Kleidon (1994), Busse and Green (2002)). Following Sagi and Seasholes (2007), we use market-to-book ratio in the most recent quarter to proxy for growth option. For the information uncertainty variables in Zhang (2006), since we have adjusted OR/IO for size, and used analyst coverage in Model 4, we focus on firm age, analyst dispersion, and volatility. Firm age (AGE) is the number of years since the firm was first covered by the Center for Research in Security Prices (CRSP). Forecast dispersion (DISP) is the standard deviation of analyst forecasts in month t scaled by the prior year-end stock price.

Models 3 to 5 in Table A2 Panel A show that these variables do not substantially affect our results. In all specifications, the coefficients for the interactions of our constraints measures with the winner dummy or the loser dummy are little changed (in both magnitudes and statistical

significances). In other words, after controlling for various variables known to be related to momentum profits, we still find a stronger momentum among winner stocks that institutions overweight and among loser stocks that institutions underweight. Finally, all of the results above remain the same when we use residual institutional ownership as the constraint measure in Table A2 Panel B.

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TABLE A1

Effects of Investment Constraints over Long-horizon

Table A1 presents average monthly returns (in percent) of momentum-overweight ratio double-sorted portfolios over the next 12 months or 24 months. At the end of each quarter from 1980 to 2013, all available stocks are sorted into five momentum quintiles (P1-P5) based on stock returns over the past six months. P1 refers to the portfolio with the lowest return and P5 the highest. The stocks are then independently sorted based on their overweight ratio into three groups (Low, Med, High). The momentum-overweight ratio portfolios are obtained by intersecting these two sorts. We report average monthly equal-weighted returns of the momentum-overweight portfolios over the subsequent 12 to 24 months. In addition, we report: (1) difference in average monthly returns between the high overweight ratio portfolio and the low overweight ratio portfolio for each momentum sort (column D(H–L)); (2) the momentum profits within each overweight ratio portfolio (row D(5-1)); and (3) difference in average monthly returns between the high overweight ratio/P5 portfolio and the low overweight ratio/P1 portfolio, as well as between the low overweight ratio/P5 portfolio and the high overweight ratio/P1 portfolio (row labeled by "P(H,L)"). We report results based on raw returns as well as results that are adjusted for the 5 by 5 size and book-to-market characteristics portfolio returns.

	Raw return					Adjusted return				
	K=12					K=12				
Momentum	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.
P1	0.874	1.103	1.123	0.249	2.54	-0.297	-0.109	-0.098	0.199	2.21
P2	1.155	1.292	1.277	0.123	1.66	-0.113	0.026	-0.007	0.107	1.60
P3	1.243	1.330	1.377	0.134	1.80	-0.049	0.054	0.067	0.116	1.79
P4	1.302	1.343	1.361	0.059	0.78	0.014	0.067	0.051	0.038	0.57
P5	1.242	1.459	1.471	0.229	2.55	-0.029	0.186	0.171	0.199	2.47
D(5,1)	0.368	0.356	0.348			0.269	0.296	0.269		
t-stat.	2.12	2.00	2.22			1.77	1.86	1.85		
P(H,L)	0.119		0.597			0.070		0.468		
t-stat.	0.72		3.14			0.45		2.86		

	K=24					K=24				
Momentum	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.
P1	1.139	1.299	1.270	0.131	1.45	-0.095	0.030	-0.001	0.093	1.14
P2	1.244	1.349	1.331	0.087	1.25	-0.041	0.060	0.022	0.063	0.99
P3	1.270	1.333	1.384	0.114	1.61	-0.022	0.054	0.069	0.092	1.48
P4	1.290	1.348	1.369	0.079	1.18	0.008	0.076	0.071	0.063	1.09
P5	1.183	1.362	1.433	0.249	3.23	-0.057	0.111	0.170	0.227	3.27
D(5,1)	0.044	0.063	0.163			0.038	0.080	0.172		
t-stat.	0.34	0.49	1.38			0.36	0.73	1.67		
P(H,L)	-0.087		0.293			-0.055		0.265		
t-stat.	-0.69		1.94			-0.48		2.16		

TABLE A2

Controlling for Variables from Related Studies on Momentum

Table A2 reports the results of Fama-MacBeth cross-sectional regressions of individual stock returns on firm characteristics variables and measures of investment constraints. The cross-sectional regressions are run once a quarter. In quarter t's regression, the dependent variable is the average monthly stock returns over the same quarter. The overweight ratio (OR) and the residual-Institutional Ownership (RIO) are measured at the end of quarter t-1. The control variables include firm size measured at the end of last quarter, book-to-market equity ratio (B/M) and return on equity (ROE) measured as of the end of the previous year, standard deviation of monthly returns over the past two years expressed in percent (Volatility), average monthly turnover over the past six months (Turnover), average monthly stock returns over the past six months (Moment(-6)), and the net institutional trading over the past six months (Trading). Panel A reports the results based on the overweight ratio. Panel B reports the results based on residual-IO. Model 1 adds as regressors the interactions of change of breadth of ownership (CB) with the past losers dummy and with the past winners dummy. Change of breadth of ownership is defined as percentage change of the number of institutions that hold the stock between the end of quarter t-2 and the end of quarter t-1. Model 2 adds as regressors the interactions of residual analyst coverage variable (Cov) of Hong, Lim and Stein (2000) with the past losers dummy and with the past winners dummy. Model 3 adds as regressors the interactions of trading volume (Volume) of Lee and Swaminathan (2000) with the past losers dummy and with the past winners dummy. Trading volume is defined as average daily turnover over the past six months. Model 4 adds as regressors the interactions of growth option (Growth) of Sagi and Seasholes (2007) with the past losers dummy and with the past winners dummy. Growth option is defined as market-to-book ratio of most recent quarter. Model 5 adds as regressors the interactions of several information uncertainty measures of Zhang (2006) with the past losers dummy and with the past winners dummy. Firm age (Age) is the number of years since the firm was first covered by CRSP. Forecast dispersion (DISP) is the standard deviation of analyst forecasts in month t scaled by the prior year-end stock price. The table reports the time-series averages of the estimated coefficients from the cross-sectional regressions and their t-statistics.

Panel A. The Impact of Overweight Ratio (OR)

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Parameter	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Intercept	1.370	7.49	1.355	7.45	1.384	7.72	1.351	7.51	1.361	7.54
Size	-0.011	-1.40	-0.011	-1.40	-0.012	-1.42	-0.012	-1.42	-0.012	-1.42
B/M	0.119	1.41	0.095	0.99	0.113	1.34	0.123	1.47	0.109	1.29
ROE	0.081	0.74	0.149	1.21	0.110	1.00	0.125	1.17	0.135	1.26
Volatility	-0.030	-1.70	-0.024	-1.34	-0.027	-1.54	-0.027	-1.52	-0.028	-1.50
Turnover	-0.021	-3.02	-0.025	-3.44	-0.026	-3.28	-0.021	-3.08	-0.022	-3.02
Moment(-6)	4.863	3.20	5.898	3.88	4.470	2.82	4.449	2.82	4.394	2.71
Trading	-0.265	-1.15	-0.121	-0.50	-0.140	-0.59	-0.142	-0.60	-0.178	-0.77
OR	0.443	1.52	0.405	1.37	0.454	1.56	0.378	1.31	0.393	1.36
Loser*OR	1.108	2.73	1.018	2.24	1.037	2.49	1.096	2.76	1.051	2.61
Winner*OR	0.937	2.06	0.851	2.14	0.895	2.18	0.951	2.12	0.873	1.97
Loser*CB	0.000	0.13								
Winner*CB	0.007	2.98								
Loser*Cov			0.301	3.29						
Winner*Cov			0.325	3.07						
Loser*Growth					7.352	0.51				
Winner*Growth					27.504	2.34				
Loser*Volume							-0.019	-1.65		
Winner*Volume							0.040	1.85		
Loser*Age									0.008	3.61
Winner*Age									-0.006	-2.10
Loser*Volatility									-0.011	-1.59
Winner*Volatility									0.016	2.60
Loser*DISP									-0.023	-0.32
Winner*DISP									-0.118	-0.45

Panel B. The Impact of Residual-Institutional Ownership (RIO)

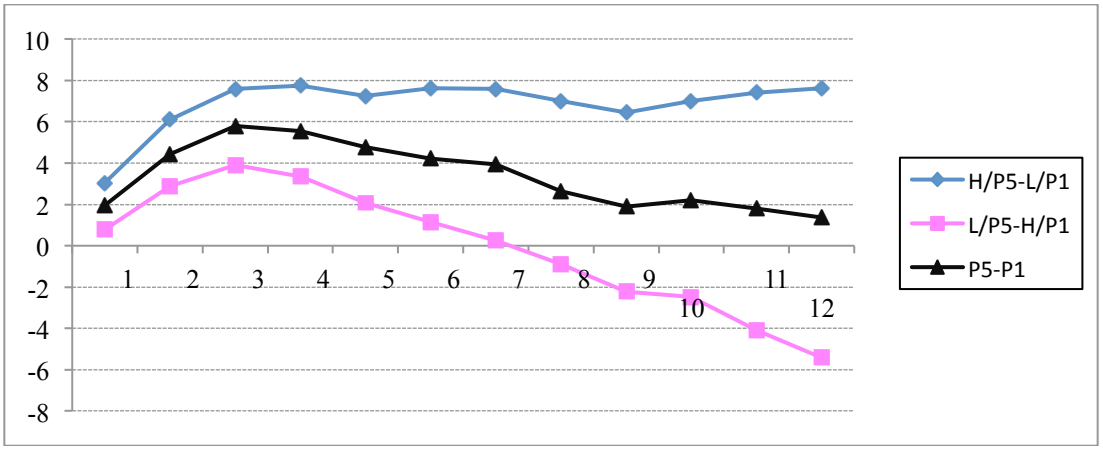
	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Parameter	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Intercept	1.422	7.31	1.399	7.33	1.420	7.60	1.394	7.43	1.394	7.47
Size	-0.008	-0.99	-0.009	-1.14	-0.008	-1.05	-0.008	-1.06	-0.008	-1.08
B/M	0.118	1.38	0.094	0.97	0.114	1.33	0.120	1.43	0.108	1.26
ROE	0.102	0.92	0.169	1.33	0.132	1.19	0.151	1.38	0.152	1.41
Volatility	-0.032	-1.84	-0.027	-1.48	-0.030	-1.69	-0.029	-1.65	-0.029	-1.58
Turnover	-0.021	-2.99	-0.024	-3.35	-0.025	-3.22	-0.021	-3.06	-0.021	-2.97
Moment(-6)	4.894	3.25	5.899	3.89	4.795	2.99	4.541	2.90	4.432	2.74
Trading	-0.493	-1.83	-0.255	-0.93	-0.357	-1.34	-0.371	-1.39	-0.388	-1.48
OR	0.319	1.42	0.228	1.08	0.299	1.41	0.265	1.24	0.259	1.22
Loser*RIO	0.574	2.30	0.433	2.07	0.573	2.21	0.603	2.34	0.591	2.26
Winner*RIO	0.843	3.26	0.576	2.41	0.773	3.04	0.920	3.67	0.841	3.30
Loser*CB	0.000	0.01								
Winner*CB	0.007	2.94								
Loser*Cov			0.309	3.55						
Winner*Cov			0.284	2.81						
Loser*Growth					8.157	0.57				
Winner*Growth					24.051	2.02				
Loser*Volume							-0.021	-1.69		
Winner*Volume							0.037	1.70		
Loser*Age									0.009	3.74
Winner*Age									-0.006	-2.23
Loser*Volatility									-0.013	-1.83
Winner*Volatility									0.015	2.47
Loser*DISP									-0.029	-0.42
Winner*DISP									-0.107	-0.40

FIGURE A1

Cumulative Returns of Portfolio Strategies Based on Price Momentum and Portfolio Constraint in Event Time

Figure A1 shows the cumulative returns up to 12 quarters after portfolio formation. At the end of each quarter between 1980 and 2013, we first sort stocks into quintiles (P1-P5) based on stock returns over the past six months. P1 refers to the portfolio with the lowest return and P5 the highest. Then we independently sort the stocks into three groups (Low, Med, High) based on their overweight ratio and residual institutional ownership respectively. Graph A reports results (return in percent) based on the momentum-overweight ratio sort. Graph B reports results based on the momentum-residual IO sort. It shows profits of the usual momentum strategy (P5-P1), as well as returns to two closely related portfolio strategy that conditions on overweight ratio: H/P5-L/P1 is long the high overweight ratio winners and short the low overweight ratio losers; L/P5-H/P1 is long the low overweight ratio winners and short the high overweight ratio losers.

Graph A. Momentum Strategies based on Level of Overweight Ratio



Graph B. Momentum Strategies based on Level of Residual IO